EXHIBIT F

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner

v.

COREPHOTONICS LTD.,
Patent Owner

Case IPR2018-01146
Patent 9,568,712 B2

PATENT OWNER'S OPENING BRIEF PURSUANT TO PAPER 39

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I. INTRODUCTION

Patent Owner Corephotonics Ltd.. ("Corephotonics") submits this brief pursuant to the Board's Order in Paper 39 requesting additional briefing regarding claims 6 and 14 of the '712 patent. Corephotonics respectfully submits that notwithstanding the issues identified in the Federal Circuit's decision in this matter, the Petition failed to establish invalidity of either of claims 6 or 14. The Board's prior finding that Petitioner failed to carry its burden to show invalidity of these claims was supported by multiple bases other than the fact identified by the Federal Circuit as a "mathematical error." Patent Owner addresses each of the issues identified by the Board in turn below, but notes that the burden remains with Petitioner to establish invalidity, not with Patent Owner to disprove Petitioner's assertions.

II. ISSUES IDENTIFIED BY THE BOARD

A. Whether Petitioner's Challenge To Claims 6 and 14 Sufficiently Accounts For Obviousness Of The Entirety Of The Claimed Combination

The Petition relies on the combination of the Konno and Bareau references to assert invalidity of dependent claims 6 and 14. Claim 6 depends from independent claim 1 and dependent claim 2. Claim 14 depends from independent claim 1 and dependent claims 12 and 13. Thus, both claims 6 and 14 must, among other elements

include all elements of claim 1. The Board found that the Konno reference did not disclose all elements of claim 1 without modification, and that finding was affirmed by the Federal Circuit. In particular, the Board correctly found that Konno does not disclose the lens assembly of claim 1 of the '712 patent because Konno's theoretical dimensions are based upon fourth and fifth lens elements that occupy the same physical space – an impossibility in the physical universe.

Claims 6 and 14 of the '712 patent add a requirement that the lens assembly F# be smaller than 2.9. Petitioner addresses these claims at pages 56-74 of the Petition. This discussion is entirely focused on the specific additional element of claims 6 and 14, and does not address any of the elements of claim 1 or any other claim from which claims 6 and 14 depend. Petitioner appears to rely solely on its discussion of its anticipation ground over the Konno reference for these claim elements.

As noted above, the Board held that Konno did not disclose all of the elements of claim 1 and that finding was affirmed by the Federal Circuit. Petitioner did not argue in its Petition that any aspect of Konno would be modified by a person skilled in the art in order to meet the elements of claim 1, nor did Petitioner identify any modification of Konno to meet those elements in its discussion of claims 6 and 14. The Petition's discussion of claims 6 and 14 focuses entirely on modifying Konno by changing the "aperture stop diameter." *See* Petition at 67-71. Specifically,

Petitioner discussed a modification of Konno in which "the aperture diaphragm ST has been moved toward the image-side of the lens assembly to allow more light to pass through the lens elements." Petition at 72. Petitioner went on to assert that "a POSITA would have found it obvious to change the size and position of the lens aperture stop of Konno's Example 2-LN2 lens assembly to decrease the F number to 2.8" Petition at 73. Petitioner did not argue for other modifications of Konno to meet the elements of claim 1, nor present evidence of the motivation for any such modifications in the Petition. Accordingly, the Board's findings (affirmed by the Federal Circuit) that Konno fails to disclose the elements of claim 1 is also fatal to the Petition's grounds regarding claims 6 and 14.

B. Whether The "Adjustable Iris Diaphragm" In Walker Is Relevant To Konno's Aperture Stop

The Petition did not identify Walker as a reference to be combined with Konno as an obviousness combination. The Petition asserted obviousness for claims 6 and 14 based on Konno combined with Bareau. The Petition relied upon Konno for all elements except the F# element of claims 6 and 14. It did not identify Walker as a part of the combination. Thus, Patent Owner respectfully submits that reliance on Walker to supply an element of the combination is outside the proper scope of the Petition.

Even if Walker could properly be considered in connection with the Petition's challenge to claims 6 and 14, Petitioner has failed to show that the "adjustable iris

diaphragm" described in Walker would have any applicability to the disclosures in Konno. The discussion of an adjustable iris diaphragm in Walker that the Petition cites comes from a general discussion of lenses far larger than the miniaturized lenses addressed by the '712 patent. For example, claim 1 of the '712 patent addresses a lens assembly with a Total Track Length (TTL) of 6.5 mm or less, and an Effective Focal Length (EFL) slightly greater than the TTL, so that the ratio of TTL/EFL is less than 1.0. For example, an embodiment described in the specification of the '712 patent describes a lens assembly with a TTL of 5.904 mm and an EFL of 6.90 mm. Ex. 1001 at 4:40-42. The relevant passages of Walker, by contrast describe a hypothetical lens with an EFL of 143 mm. Ex. 1016 at 59. While such a lens might be practical for a large single lens reflex (SLR) camera, it is not consistent with the compact lenses addressed by the challenged claims.

Further, Walker describes the "adjustable iris diaphragm" as a movable component that "allows the effective diameter of the lens to be varied such that the brightness of the image formed at the detector is constant, regardless of the brightness of the scene being imaged." Ex. 1016 at 59-60. While such components are common on large camera lenses, such as those used in conventional SLR cameras, Petitioner provides no evidence that such components would be used in the dramatically more compact lenses addressed by the challenged claims.

Petitioner's references to an adjustable iris diaphragm are also contradictory to Petitioner's arguments about modification of the location of the aperture stop of Konno. Petitioner argues that to achieve an F# lower than 2.9, the aperture stop of Konno would be moved closer to the image plane. Petition at 63-65. Petitioner creates a diagram of such an adjustment on page 64 of the Petition, showing that the relocated aperture stop is moved to the right (in the image) of the object side of the first lens element. In other words, the new aperture stop proposed by Petitioner surrounds the physical edge of the first lens element. Because that edge of the lens element is a physical object, the aperture iris diaphragm could not be adjusted. It would be impossible to contract the iris because any contraction would impinge on the physical structure of the lens element itself. This further shows the inapplicability of Walker's "adjustable iris diaphragm" relied on by Petitioner.

Petitioner provides no evidence 1) that an adjustable iris diaphragm would be used in the compact lens assemblies addressed by the challenged claims; 2) that an aperture stop located at the physical edge of a lens element could ever physically be an adjustable iris diaphragm; or 3) that a person of skill in the art would ever place an aperture stop closer to the image plane than the object side of the first lens element in a compact lens assembly of the type addressed by the challenged claims. Each of these failures renders Petitioner's reliance on Walker and the "adjustable iris diaphragm" discussed therein unsupported.

C. Whether A Combined Lens Assembly Must Be Adjusted To Account For Optical Effects Of Changing Aperture Size

Patent Owner, and its expert, Dr. Moore, provided a detailed discussion of the optical effects that simply changing aperture size would have, including creating spherical aberrations, vignetting, and reduced relative illumination. *See* Ex. 2013 at ¶¶ 109-115. Petitioner neither accounts for, nor explains the motivation for a person skilled in the art to make a modification that would result in such aberrations solely to achieve a lower F# (an impermissible hindsight rationale). Ironically, as Petitioner argues, a lower F# should, in theory, result in more light passing through a lens assembly and thus greater illumination at the image plane. *See* Petition at 63. However, as shown in the Moore declaration, Petitioner's proposed adjustments actually achieved the opposite result – lower relative illumination. Ex. 2013 at ¶ 113. Petitioner failed to explain why a person skilled in the art would make only the modifications Petitioner proposed (resulting in reduced image quality) rather than sufficient modifications to actually result in comparable or improved image quality to the system to be modified, and Petitioner failed to show that if a person skilled in the art actually made modifications to improve or even maintain image quality, that all of the other requirements of the challenged claims (including the various length and lens element parameters) would be met. Petitioner's failure to show these elements in the Petition further shows that the proposed combination lacks merit.

D. Whether a POSITA Would Have Modified Konno With Bareau As Proposed By Petitioner In Light Of Various Considerations

The Board identified five considerations that might affect whether a POSITA would have modified Konno with Bareau as proposed by Petitioner to yield the inventions of claims 6 and 14. As set forth in connection with the previous items, and in Patent Owner's response to the Petition more generally, Patent Owner respectfully submits that a person skilled in the art would not have modified Konno in the manner proposed by Petitioner. We address each of the Board's identified considerations below.

1. Konno disclosure of a first system with an F# of 3.0 and a second system with an F# of 4.0 and further disclosure of the advantage of making the second system darker than the first

The disclosure of Konno referenced by the Board in this consideration strongly teaches away from making the modification proposed by Petitioner. The only imaging optical system of Konno relied upon by Petitioner (incorrectly) to satisfy the elements of challenged claim 1 is the second system of Konno. As discussed in the reference and conceded in the Petition, that system is recited to have an F# of 4.0. Further, as discussed in Konno, it is the darker of the two systems – having a higher F# than the other system. Konno's teaching that it is advantageous to have the second system be darker than the first teaches that the F# of the second system should be higher than 3.0. 3.0 is obviously higher than 2.9 and thus would

not satisfy the requirements of either challenged claim 6 or 14. Konno's disclosure thus teaches away from the modification proposed by Petitioner, which proposes to make the second system "lighter" than the first, the opposite of the teaching of Konno.

2. Bareau disclosure of a ¼" sensor with a field of view of 60 degrees and an F# of 2.8

As discussed in the Patent Owner Response, as cited in the Board's Order, the disclosure of Bareau is explicitly directed to a wide angle camera for a mobile device. The Konno reference, as noted in the previous section, discusses a camera system with two optical systems. The second of those systems is the one relied on by Petitioner as purportedly having a longer EFL than TTL (though not disclosing an actual lens assembly with those characteristics). Konno describes the first system as providing a "wide angle" and the second system as providing a longer, telephoto, lens property. Ex. 1015 at ¶ 0007. Thus, in Konno, the first optical system (not relied on by Petitioner) is the wide-angle lens system that would correspond to any teaching in Bareau regarding such lenses. The F# recited for the first system (3.0) is also much closer to the F# (2.8) referenced in Bareau. Thus, if a POSITA were to make any combination involving Bareau and Konno (something that Petitioner has not adequately shown), such a modification would be to the first system of Konno (the wide-angle system), not the second, telephoto system of Konno relied on by Petitioner. The Petition fails to account for these teachings in Konno and suggests

that a skilled artisan would take only those elements of Konno useful to meet the end result of the challenged claims, and ignore its other teachings to make a counterindicated combination with Bareau – combining Bareau's wide-angle lens disclosures with the telephoto lens of Konno, rather than the wide-angle lens of Konno. Petitioner's contentions thus rely on impermissible hindsight, not the teachings of the actual asserted prior art.

3. Petitioner's proposal to lower the F# of Konno's *second imaging optical system* to 2.8 – less than the F# of Konno's first imaging optical system

This consideration implicates the same issues as consideration (1) discussed above. As set forth there, Konno teaches that the second imaging optical system should be darker – have a higher F# - than the first imaging optical system. Petitioner's proposed modification would reverse this relationship, resulting in a modification directly opposite to the explicit teaching of Konno.

4. Petitioner's assertion that Iwasaki discloses a prior art lens system with TTL of 3.89, EFL of 4.0, and F# of 2.8

Petitioner did not cite or rely on Iwasaki in any way in the Petition, nor assert it as a part of any ground asserted in the Petition. The Petition does not suggest that Iwasaki discloses the lens assembly of any challenged claim. Petitioner appears to suggest that Iwasaki teaches some advantage in having an F# of 2.8 and that this would somehow constitute a motivation to combine Bareau with the second optical

system of Konno. Petitioner does not, however, point to any teaching in Iwasaki that suggests an advantage to the F# of 2.8. Rather, Petitioner merely points to the happenstance that the lens assembly of Iwasaki has an F# of 2.8. Petitioner ignores, however, the other teachings of Iwasaki which make clear that it, like Bareau, describes a wide-angle lens, unlike the telephoto lens of Konno's second optical system. For example, Iwasaki states that the lenses described therein "have full angles of view within a range from 70 degrees to 75 degrees." Ex. 1021 at 12:16-21. Thus, Iwasaki itself indicates that it is discussing even wider angle lenses than those of Bareau (which had approximately 60 degree angles of view). Thus, Iwasaki adds nothing to Petitioner's analysis and provides no indication that a skilled artisan would be motivated to combine Bareau's wide-angle lens disclosure with the telephoto optical system of Konno (rather than the wide-angle optical system of Konno).

5. The Federal Circuit's inquiry as to whether "Bareau's teachings are limited to wide-angle lens assemblies," in light of the fact that Petitioner "sought to modify Konno's telephoto lens assembly"

This consideration leads to a similar conclusion as several of the previous considerations. As discussed throughout the preceding sections, the disclosures of Bareau relied upon by Petitioner relate to properties of a wide-angle lens system. The portions of Konno that Petitioner relies upon relate to a telephoto optical system, in contrast to the separate wide-angle system also discussed in Konno. Petitioner

argues that a person skilled in the art would be motivated to mix and match these teachings to combine them to reach the challenged claims. However, Petitioner points to no teaching in Bareau, Konno, or any other reference, suggesting that there is an advantage to lowering the F# only of a telephoto optical system in a two-lens system, much less to lower it below even the F# of the corresponding wide-angle lens of the system. As discussed previously, Konno expressly teaches away from just such a modification. This consideration further indicates that the Board was correct at the outset in concluding that Petitioner failed to show that a skilled artisan would be motivated to modify Konno in light of Bareau as proposed by Petitioner. Each of the Board's five identified considerations point squarely away from such a combination.

III. CONCLUSION

The Board found in its Final Written Decision that Petitioner failed to establish that a person skilled in the art would combine Konno and Bareau to yield the inventions of challenged claims 6 and 14. While the Federal Circuit noted that the modification of Konno's telephoto lens assembly to have an F# of 2.8 would not violate conditional expression 5 of the Konno reference, it did not suggest that Konno provided any teaching supporting the combination Petitioner proposes. The Federal Circuit also did not suggest that the Board erred in its other findings, such as its determination that the portions of Bareau relied upon by Petitioner involved

wide-angle lenses, while the portions of Konno relied upon by Petitioner involved telephoto lenses. *See* Final Written Decision at 27-29. Likewise, the Federal Circuit did not suggest that the Board erred in finding that Konno taught that the telephoto lens was preferably "darker" – had a higher F# - than the accompanying wide-angle lens.

The Federal Circuit merely remanded in light of its assertion of error in the calculation of conditional expression 5 of Konno for the Board to determine if that conditional expression was the only basis for finding that Petitioner failed to carry its burden to demonstrate that a person skilled in the art would be motivated to combine Bareau and Konno to achieve the inventions of challenged claims 6 and 14. As set forth in the various sections above, there are many reasons, entirely independent of Konno's conditional expression 5, that a person skilled in the art would not be motivated to combine Bareau and Konno as proposed by Petitioner. Petitioner bears the burden of persuasion on this issue, and the Board correctly found that Petitioner failed to carry that burden. Thus, the Board should reinstate its finding that Petitioner has failed to show that claims 6 and 14 are unpatentable.

Respectfully submitted,

Dated: November 15, 2021

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CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e)(1))

The undersigned hereby certifies that the above document was served on November 15, 2021, by filing this document through the Patent Trial and Appeal Board End to End system as well as delivering a copy via electronic mail upon the following attorneys of record for the Petitioner:

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Paper No._____

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Case IPR2018-01146
Patent No. 9,568,712

PETITIONER'S BRIEFING PER THE BOARD'S ORDER AT PAPER 39

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PETITIONER'S EXHIBIT LIST

Updated: June 21, 2019

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Ex. 1003	Declaration of José Sasián, Ph.D, under 37 C.F.R. § 1.68
Ex. 1004	Curriculum Vitae of José Sasián
Ex. 1005	Reserved
Ex. 1006	Warren J. Smith, MODERN LENS DESIGN (1992) ("Smith")
Ex. 1007	U.S. Patent No. 7,918,398 to Li et al. ("Li")
Ex. 1008	U.S. Patent No. 7,777,972 to Chen et al. ("Chen")
Ex. 1009	U.S. Patent No. 8,233,224 to Chen ("Chen II")
Ex. 1010	Max Born et al., PRINCIPLES OF OPTICS, 6th Ed. (1980) ("Born")
Ex. 1011	Reserved
Ex. 1012	Jane Bareau et al., "The optics of miniature digital camera modules," SPIE Proceedings Volume 6342, *International Optical Design Conference 2006*; 63421F (2006) https://doi.org/10.1117/12.692291 ("Bareau")
Ex. 1013	U.S Patent No. 3,388,956 to Eggert et al. ("Eggert")
Ex. 1014	Japanese Patent Pub. No. JP2013106289 to Konno et al.
Ex. 1015	Certified English translation of JP2013106289 ("Konno")
Ex. 1016	Bruce J. Walker, OPTICAL ENGINEERING FUNDAMENTALS (1995) ("Walker")
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Ex. 1025	Deposition transcript of Duncan Moore, Ph.D.
Ex. 1026	Declaration of Dr. José Sasián in support of Petitioner's Reply
Ex. 1027	U.S. Patent No. 4,610,514 to Nakamura ("Nakamura")

I. Question 1: Petitioner's challenge to dependent claims 6 and 14 sufficiently accounts for obviousness of the entirety of the claimed combination in the Petition.

A. Question (1)(a): Whether Petitioner's challenge to dependent claims 6 and 14 sufficiently accounts for obviousness of the entirety of the claimed combination … in the Petition ….

Claims 6 and 14 of the '712 patent depend respectively from claims 1, 2, 12, and 13. *See* Ex. 1001, 8:1-4, 32-33, 52-61. Ground 1 in the Petition shows how Konno's Ex2-LN2 lens design meets all of the limitations of claims 1, 2, 12, and 13. *See* Petition, Paper 2, at 13-46. Patent Owner did not dispute this. Rather, Patent Owner's only argument regarding Ground 1 was that the Ex2-LN2 design did not anticipate because it shows a small overlap between the fourth and fifth lens elements (which is immaterial to the disclosure of the claim limitations). *See id.*; Response, Paper 14, at 20-26. That overlap was the sole basis for the Board's finding of no anticipation. *See* FWD, Paper 37, at 22-23. Because the modified design in Ground 2 fixes that overlap (*see* Petition at 63-65, 69-73; Ex. 1003, pp. 71-72, 78-79, 112), the finding of no anticipation for Ground 1 is irrelevant to Ground 2.

Ground 2 in the Petition shows how a POSITA would have been motivated to modify and successful at modifying Konno's Ex2-LN2 design to lower the f-number to 2.8 for a ¼" sensor (as taught by Bareau) by opening the aperture and moving it closer to the first lens element, and adjusting the aspherics of the lens

elements to appropriately focus the light based on the change in f-number. *See* Petition at 63-65, 69-73; Ex. 1003, pp. 71-72, 78-79, 112. Critically, that obvious modification would have fixed the overlap error in Konno's original design. *See* Petition at 63 ("In view of Fig. 1 above, a POSITA would have been motivated to adjust Konno's Example 2-LN2 lens assembly to decrease the F number and allow more light to pass through to conform to modern cellphone camera lens specifications. Ex.1003, p.69. ***This kind of adjustment would have been routine for a POSITA to correct the errors of Konno and decrease the F number***. Ex.1003, p.70."); *see also id.* at 56-72.

As a result, the Ground 2 modification of the Ex2-LN2 design, which corrects the overlap, undisputedly meets all of the limitations of claims 1, 2, 6, 12, 13, and 14. *See* Petition at 13-46. The modifications to the Ex2-LN2 design do not change any parameters of lens elements 1-5 (i.e., radius of curvature (r), thickness and spacing of lens elements (d), index of refraction (nd), and Abbe no. (vd)), which shows how the design meets the limitations of claims 1, 2, 12, and 13 as shown in Ground 1. *Compare* Ex. 1015 ¶ 74 (original lens prescription surfaces 2-13) *with* Ex. 1003, p.115 (modified lens prescription surfaces 2-13). In other words, after modifying the Ex2-LN2 design's aperture (*compare* original lens prescription surface 1 *with* modified lens prescription surface "STO STANDARD") and aspherics to lower the f-number to 2.8, the modified design

still maintains the properties of the original Ex2-LN2 design that meet all limitations of claims 1, 2, 12, and 13.

More specifically, the Ex2-LN2 design modified in view of Bareau maintains the properties of Konno's original design with two obvious changes—(1) modifying the aspherics to better focus light, which also corrects the overlap (and therefore why the no-anticipation determination for Ground 1 is irrelevant to Ground 2), and (2) opening and moving the aperture toward the first lens to lower the f-number to 2.8. *See* Petition at 61-65. Moving the aperture closer to the first lens element shortens the TTL parameter of the original Ex2-LN2 design by 0.05 mm. *See* Petition at 64-65; Ex. 1003, p.112. Because both limitations to which TTL is relevant remain satisfied, the modification does not alter the analysis in Ground 1: the TTL, 4.856 mm (*see* Ex. 1003, p.112), remains less than 6.5 mm (limitation [1.4]) and the TTL/EFL ratio, 4.856 mm / 5.5195 mm, remains less than 1.0 (limitation [1.5]). *See* Petition at 21-24, 71-73; Ex. 1003, p.112 (showing TTL of the modified design of 4.856 mm versus the original TTL of 4.91 mm).

Because Patent Owner never argued that the original and modified Ex2-LN2 designs do not disclose the claim limitations (*see* Response at 20-39), there is and can be no dispute between the parties that the Petition's challenge to claims 6 and 14 sufficiently accounts for the entirety of the claimed combination. Any such arguments have now been waived. *See* Scheduling Order, Paper 9, at 5 ("The

patent owner is cautioned that any arguments for patentability not raised and fully briefed in the response will be deemed waived."); Trial Practice Guide at 94; *see also SAP Am., Inc. v. Versata Dev. Group, Inc.*, CBM2012-00001, Paper 81 at 2-4 (Sept. 13, 2013).

B. Question (1)(b) … where in the Petition or briefing in the record there is an explanation of how and why to modify Konno given that the Petition does not expressly incorporate its anticipation challenge into its obviousness challenge (see Pet. 56–74) and that the Board's determination as to Petitioner's anticipation challenge was affirmed;

As discussed above, the Petition's Reasons to Combine in Ground 2 and analysis for claim 6 (which also applies to claim 14) specifically describe how a POSITA would have modified Konno's Ex2-LN2 applied in Ground 1 to lower the f-number to 2.8, which does not affect how the design meets the limitations of claims 1, 2, 12, and 13. *See* Petition at 58-65. In that analysis, Dr. Sasián opened the aperture and moved it back toward the first lens to yield an f-number of 2.8 then performed "routine aspheric coefficient optimization" to better focus light for the f-number change, which also corrects overlap between the 4th and 5th lens elements. *See* Petition at 61-65, 69-75. Dr. Sasián modified the aperture because in Konno's original design it "is placed well in front of the object-side surface of the first lens L1, and blocks a significant amount of light passing through the lens assembly." Petition at 63; Ex. 1003, p.69. Opening and moving the aperture toward

the first lens element was found by Dr. Sasián "to allow more light to pass through the lens elements" which "conform[s] to modern cellphone camera lens specifications" of an f-number of 2.8 for a ¼" sensor as taught by Bareau. *See* Ex. 1012, p.3. Petition at 63-65; Ex. 1003, p.69-70. Patent Owner makes no argument that a POSITA would have not been successful in (1) moving and opening the aperture and (2) adjusting the aspherics to yield a modified Ex2-LN2 design with an f-number of 2.8. This is discussed in more detail in the sections below.

Because dependent claim 6 includes the limitations of claims 1 and 2, and dependent claim 14 includes the limitations of claims 1, 12, and 13, Ground 2 necessarily relies on the analysis in Ground 1 to show how the Ex2-LN2 design meets claims 1, 2, 12, and 13. This is evident from both grounds in the Petition because Ground 1 relies on Konno's Ex2-LN2 design and Ground 2 shows how a POSITA would have modified that same design based on Bareau's teachings to achieve a lower f-number without changing the prescription of the lens elements. Ground 2 also explains what modifications a POSITA needed to make to the Ex2-LN2 design for a lower f-number (i.e., opening and moving the aperture and adjusting aspherics) and why a POSITA would have been motivated to do so.

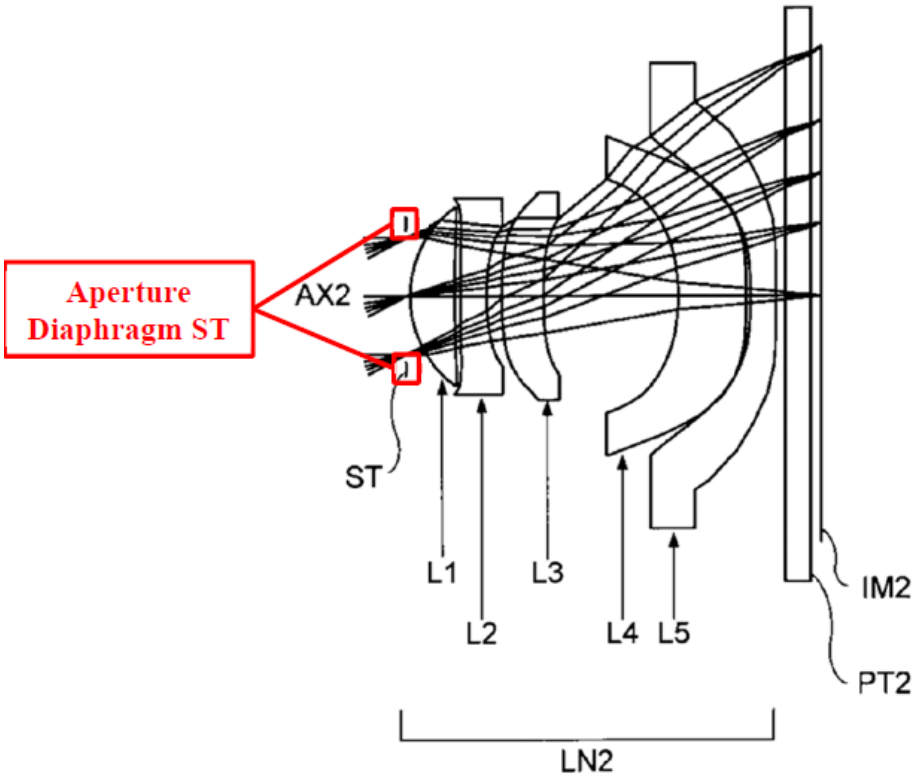
Moreover, if claims 6 and 14 are found to be obvious, Federal Circuit precedent requires the Board to also find claims 1, 2, 12, and 13 obvious for the same reasons as a matter of law. *See Callaway Golf Co. v. Acushnet Co.*, 576 F. 3d

1331, 1344 (Fed. Cir. 2009) citing *Ormco Corp. v. Align Tech., Inc.*, 498 F.3d 1307, 1319 (Fed. Cir. 2007) ("A broader independent claim cannot be nonobvious where a dependent claim stemming from that independent claim is invalid for obviousness."); *Ormco Corp. v. Align Technology, Inc.*, 498 F. 3d 1307, 1319-20 (Fed. Cir. 2007) ("Claim 10 is dependent on independent claim 1, and claim 17 is dependent on independent claim 11. Because claims 10 and 17 were found to have been obvious, the broader claims 1 and 11 must also have been obvious.").

II. Question 2: The Petition relies on Walker showing the knowledge of a POSITA regarding changing f-numbers based on opening the aperture, and is not limited to an "adjustable iris diaphragm."

In Question 2, the Board asks whether the "adjustable iris diaphragm" of Walker "is relevant to Konno's aperture stop which Patent Owner characterizes as disclosing a 'fixed aperture stop'" (*see* Paper 39 at 3). It is. The Petition broadly relies on Walker's disclosure of the knowledge that a POSITA would have had regarding adjusting an aperture, which is not limited only to adjustable apertures.

Patent Owner points to Walker's reference to "an adjustable iris diaphragm" to argue that "Walker's teaching is not relevant to the '712 patent's claims, which are drawn to cell phones with fixed aperture stop sizes." Response at 33. Patent Owner's argument is inapt, however, because the Petition does not rely on Walker to incorporate an aperture into Konno. As Patent Owner acknowledges, Konno already has a fixed aperture, namely "Aperture Diaphragm ST" in Fig. 16 (below).



Petition, p.61; Ex. 1003, p.68; Ex. 1015, Fig. 16 (annotated).

The Petition relied on Walker for its disclosure of the well-known formula for f-number and to show that a POSITA would have understood the relationship between aperture diameter and f-number. *See* Petition at 60. The Petition states that "a POSITA would have known the well-known formula for F number as stated by Walker: ... f number $= \frac{\text{EFL}}{\text{diameter}}$," and thus "a POSITA would have recognized that by changing the diameter of the entrance pupil (i.e., changing the aperture stop diameter), the F number can be changed." *Id.* (citing Ex. 1016, p.59).

Patent Owner's expert, Dr. Moore, admitted that a POSITA would have known this relationship between the f-number and aperture of a lens assembly and how to apply this knowledge to open the aperture to lower the f-number:

> Q. So if a person of ordinary skill in the art designing a five-lens system started with a patent and they didn't like that the f-number was too high, one of the first variables they would correct would be to lower that f-number and hold that constant while they design the rest of the lens?
>
> A. That would be the normal process, yes.
>
> Q. And to lower that f-number they would have to open the aperture?
>
> A. Either open the aperture or change the focal length. But if the focal length is fixed, then the only choice you've got is opening the aperture.
>
> Q. And that would be something a person of ordinary skill in the art would know?
>
> A. Yes.

Reply, Paper 22, at 20-21; Ex. 1025, 105:2-16. The Petition also cites other references for this well-known concept. *See e.g.*, Ex. 1005, p.63 (discussing "numerical aperture" and "corresponding f number" of a lens); Ex. 2003, pp.4, 13 (discussing "changing the f/number" of a design).

Regardless, Walker's discussion of apertures is not limited to adjustable apertures as Patent Owner argues. The Petition cites Walker's statement that "***[a]ny lens assembly*** will have one lens aperture, or mechanical component, that limits the diameter of the axial bundle of light (that bundle of light rays originating at the center of the object) that is allowed to pass through the lens to the imaging plane." *See* Petition at 67 (citing Ex. 1016, p.59). An adjustable aperture is merely

one example given, but, consistent with Dr. Moore's opinion, a POSITA would have understood the teachings of Walker to apply to the concept that f-number can be lowered by opening the aperture, which applies to any type of lens assembly, including those with both adjustable and fixed aperture stops. *See id*.

The Petition also established that a POSITA would have understood the benefits of lowering the f-number: "[i]n view of Fig. 1 above, a POSITA would have been motivated to adjust Konno's Example 2-LN2 lens assembly to decrease the F number and ***allow more light to pass through to conform to modern cellphone camera lens specifications***." Petition at 63; *see also* Ex. 1016, p.59; Ex. 1012, pp.3-4. Dr. Moore likewise agreed that a lower f-number is more desirable:

> Q. But a person of ordinary skill in the art holding all else equal understands that lower f-numbers mean better cameras in cell phones; correct?
>
> A. If everything else is constant, the answer is yes.

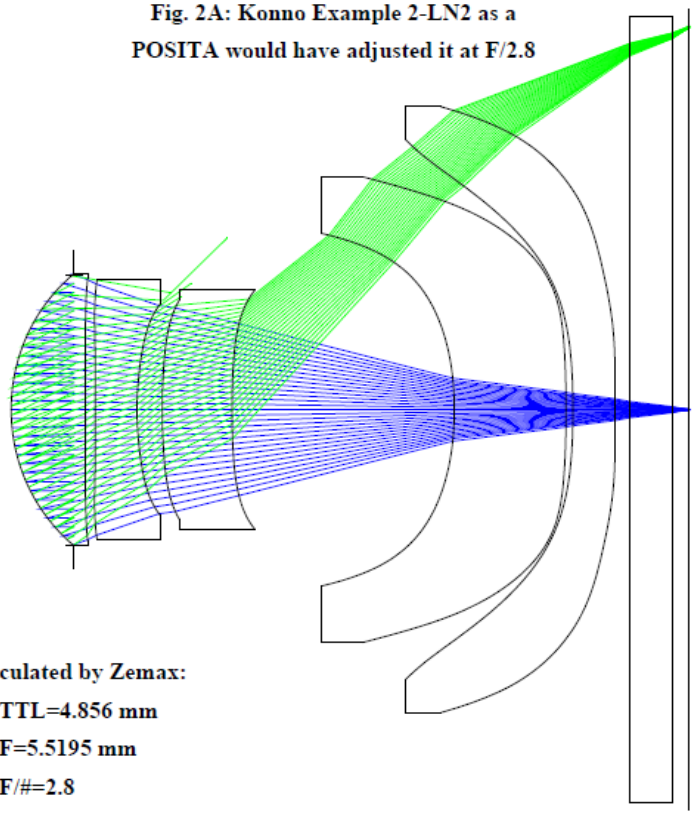
Ex. 1025, 122:9-13. The Board in an IPR on a related patent also agreed with this. *See* IPR2020-00878, FWD, Paper 29 at 25 ("Petitioner has shown an artisan seeking to improve upon or otherwise modify Ogino would have tried to lower the f-number because of the known advantages provided by such a lower f-number.").

Thus, the evidence of record, including the knowledge of a POSITA disclosed in Walker, amply shows that a POSITA would have been motivated to lower the f-number of Konno's lens assembly by first changing the aperture size.

III. Question 3: The modified Ex2-LN2 design relied on in Ground 2 was "adjusted to account for the optical effects due to changing the aperture stop size."

In Question 3, the Board asks "[w]hether, in the combination of Konno and Bareau, 'the lens assembly must instead be adjusted to account for the optical effects due to changing the aperture stop size,' as Patent Owner contends." Paper 39 at 3; *see* Response at 33. It does not. These adjustments were already accounted for in the modified Ex2-LN2 design provided in Dr. Sasián's declaration:

Fig. 2A: Konno Example 2-LN2 as a POSITA would have adjusted it at F/2.8



As calculated by Zemax:

- **TTL=4.856 mm**
- **F=5.5195 mm**
- **F/#=2.8**
- **Focal length of L1 is 2.537 mm. Hence L1 has positive optical power.**
- **L1 has a convex front surface and a concave rear surface per the radii in the prescription.**
- **L2 is a meniscus lens with a convex object surface and a concave image surface per the radii in the prescription.**
- **Focal length of combined L2 and L3 = -4.7366 mm. Hence the optical power is -0.2111.**

Ex. 1003, p.112.

Dr Sasián's modifications included adjusting the lens assembly to account for the optical effects of changing the f-number. *See* Reply, Paper 22, at 19-20; Ex. 1003 pp.69, 80. As discussed in the Reply, Dr. Sasián first loaded the lens prescription data for Konno's Ex2-LN2 design into Zemax. Reply at 19; Ex. 1003, p.69. After setting the f-number to 2.8 by adjusting the size and location of the aperture based on Bareau's teachings, Dr. Sasián then used Zemax to automatically optimize the Ex2-LN2 lens design to find the best solution with an f-number of 2.8. *See id*. Dr. Sasián testified that this modification "involved only the well-known use of lens apertures to change the F number and ***routine optimization of aspheric coefficients using a lens design program***." Ex. 1003, p.80. This optimization represents adjustments to account for optical effects due to changing the aperture stop size, including adjusting the aspherics to better focus light, which also corrects the overlap between the fourth and fifth lens elements. *Id*.

Patent Owner's own exhibit shows that a POSITA would have used the same process as Dr. Sasián to lower the f-number of the Ex2-LN2 design, which requires no further adjustment to account for optical effects. *See* Ex. 2003 at 172-74. For example, a POSITA would first enter the parameters of an existing design into a lens design program and then "establish the variables and constraints" for the new design, including the aperture size to account for the desired f-number. Ex. 2003 at 172-73. A POSITA would then "initiate the optimization" in the lens

design program. *Id.* at 174. This optimization occurs automatically in cycles "until the desired performance is met." *Id*. As discussed above, this is precisely how Dr. Sasián modified Konno's Ex2-LN2 design to have a f-number of 2.8 without any lens overlap. *See* Reply at 18-19; Ex. 1003, p.69. Thus, the modified Ex2-LN2 design was "adjusted to account for the optical effects due to changing the aperture stop size" according to the same method that a POSITA would have used.

IV. Question 4: The Petition shows how a POSITA would have modified Konno with Bareau to have an f-number smaller than 2.9.

In Question 4, the Board asks "[w]hether a POSITA, considering all of the following, would have modified Konno with Bareau as proposed by Petitioner to teach or suggest that the lens assembly of claim 1 has an F# that is smaller than 2.9, to which claims 6 and 14 are directed …" accompanied by subparts (a)-(e). Paper 39 at 3-4. These are addressed below.

(4a) and (4c) regarding Konno's "first imaging optical system": The Petition relies on modifying the Ex2-LN2 design (Konno's second imaging optical system) alone to meet the limitations of claims 6 and 14, and not the Ex2-LN1 wide-angle lens design (Konno's first imaging optical system). Petition at 58-65. The "darkness" or f-number of Ex2-LN1 is irrelevant to and would not have dissuaded a POSITA from modifying Ex2-LN2 as proposed. First, Konno provides separate lens specifications for each of Ex2-LN1 and Ex2-LN2 and each represents

a separate lens assembly that can be used independently from the other. *See* Ex. 1015 ¶¶ 72-75. Patent Owner's expert agreed that the Ex2-LN2 design is a "stand-alone lens system" that can be used independent of the Ex2-LN1 design. Ex. 1025, 120:21-121:2. The Petition's reliance on Ex2-LN2, independently from Ex2-LN1, in Ground 2 is permissible as "[i]t is well settled that a prior art reference is relevant for all that it teaches to those of ordinary skill in the art." *In re John R. Fritch*, 972 F.2d 1260 (Fed. Cir. 1992).

Second, Konno's statement that "***it is advantageous*** to make the second imaging optical system darker than the first imaging optical system" is merely a preference, and clearly not a requirement for the Ex2-LN2 design because, as discussed above, the LN2 design has utility and benefit in being brighter when used independently from the LN1 design. *See* Ex. 1015 ¶ 38.

Third, lowering the f-number to 2.8 for Ex2-LN2 still meets conditional expressions (5) and (5a) specifying the range allowed for the ratio between the f-numbers of Ex2-LN2 and Ex2-LN1. Konno states that "[d]esirably, a following conditional expression (5) is satisfied. $0.6 < FNOw/FNOm < 1.3$"; and "[m]ore desirably, a following conditional expression (5a) is satisfied. $0.7 < FNOw/FNOm < 1.1$" (where FNOw and FNOm refer to the f-numbers of Ex2-LN1 and Ex2-LN2, respectively). Ex. 1015 ¶¶ 37-39. Since Ex2-LN1 has an f-number of 3.0 (FNOw) and modified Ex2-LN2 has an f-number of 2.8 (FNOm), **FNOw/FNOm = 1.07** for

modified Ex2-LN2. *See id*. ¶ 76. Thus, according to Konno's teachings, the modification to Ex2-LN2 is "more" desirable because it satisfies both expressions (5) and (5a). Konno provides no indication that the "desire" to satisfy these conditional expressions is mutually exclusive to any "advantage" from "mak[ing] the second imaging optical system darker than the first imaging optical system." *Id*. ¶¶ 37-39. The record thus amply shows that Konno does in fact support using a telephoto lens with a lower f-number than the corresponding wide lens.

(4b) and (4e) regarding Patent Owner's argument that Bareau is limited to "wide-angle lens assemblies": Bareau's disclosure is not limited to wide-angle lens assemblies. This issue was decided in IPR2018-01140 where the Board stated "[w]e agree with Petitioner, however, who asserts that Bareau does not exclude telephoto lenses ... Petitioner persuasively argues that Patent Owner has not provided evidence that the person of ordinary skill would have found the lens specifications of Bareau regarding relative illumination inapplicable to telephoto cell phone lens systems." IPR2018-01140, FWD, Paper 37, at 31. Patent Owner likewise has not done so here.

The Board also agreed with the Petitioner that the field of view (FOV) of a lens assembly is not related to its f-number in IPR2020-00878 and thus is not a reason to disregard the F number of Bareau: "[w]e find Petitioner's contentions that the f-number indicates how much light reaches the image sensor regardless of

a lens's focal length or FOV (Pet. 43) persuasive, and we find that Patent Owner has not presented sufficient rebuttal why the selection of f-number would be different in narrower-angle lenses; thus, this conclusory argument does not undermine Petitioner's showing." IPR2020-00878, Paper 29 at 27. As discussed above, it is well known that the f-number of a lens assembly depends on two factors—focal length and aperture opening, and not FOV. *See* Ex. 1016, p.59.

Thus, Bareau's teaching of using an f-number of 2.8 for a ¼" sensor (*see* Ex. 1013, p.3) would have been applicable to a lens system of any FOV, including telephoto designs using a ¼" sensor like the modified Ex2-LN2 design in Ground 2. In fact, Bareau lists the f-number of 2.8 as a "typical specifications for a ¼" sensor format," which is relevant to any lens design that has a focal length and aperture, such as Konno. *See* Ex. 1012, pp.3-4. A POSITA would have understood that the f-number of 2.8 for a ¼" sensor would have been applied to a lens design independent of its FOV. According to Bareau, the f-number specification is particularly important because smaller pixel sensors that are used in cellular telephones tend to "have less light gathering capability and will suffer at slower f/numbers"; Bareau specifies an f-number of 2.8 so enough light will reach the smaller ¼" sensor. *See* Petition at 57; Ex. 1012, p.4. Thus, the Petition shows that a POSITA would have been motivated to lower the f-number of Konno's Ex2-LN2 based on Bareau, which is not limited to wide-angle lens assemblies.

Question (4d) regarding Iwasaki: Iwasaki's lens system shows that telephoto lens designs having an f-number less than 2.9 were known in the art prior to the '712 patent, which is further evidence that corroborates that a POSITA would have been motivated to lower the f-number of Konno's Ex2-LN2. *See* Reply at 16. As stated in the Reply, Iwasaki "discloses a prior art lens system with TTL of 3.89, EFL of 4.00, and F# of 2.8." *See* Reply at 16; Ex. 1021, 17:5 (Table 7). Iwasaki describes the benefits of these features including "a shortening of the total length and high imaging performance which is compatible with an increased number of pixels." Ex. 1021, 2:7-10. Thus, Iwasaki shows that, prior to the '712 patent, POSITAs were lowering the f-number of miniature telephoto lenses to have an f-number of 2.8, and it even provides a specific example filling this need which also reads on claims 1, 12, 13, and 14. *See id*.

Respectfully submitted,

Dated: November 15, 2021

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(a), this is to certify that I caused to be served a true and correct copy of the foregoing "PETITIONER'S BRIEFING PER THE BOARD'S ORDER AT PAPER 39" as detailed below:

Date of service	November 15, 2021
Manner of service	Electronic Mail to: nrubin@raklaw.com; jchung@raklaw.com; rmirzaie@raklaw.com; mfenster@raklaw.com
Documents served	PETITIONER'S BRIEFING PER THE BOARD'S ORDER AT PAPER 39
Persons served	Neil Rubin C. Jay Chung Reza Mirzaie Marc A. Fenster Russ August & Kabat 12424 Wilshire Blvd., 12th Fl. Los Angeles, CA 90025

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner

v.

COREPHOTONICS LTD.,
Patent Owner

Case IPR2018-01146
Patent 9,568,712 B2

PATENT OWNER'S RESPONSE BRIEF PURSUANT TO PAPER 39

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I. INTRODUCTION

Patent Owner Corephotonics Ltd.. ("Corephotonics") submits this response brief pursuant to the Board's Order in Paper 39 requesting additional briefing regarding claims 6 and 14 of the '712 patent. Petitioner's Opening Brief failed to demonstrate any proper basis on which claims 6 and 14 should be found unpatentable. Petitioner relies on arguments and assertions that were already rejected by both the Board and the Federal Circuit regarding independent claim 1. It then repeats incorrect assertions about the additional references that were already rejected by the Board. Its arguments regarding each of the items identified by the Board to address fail to carry its burden to support the Petition's challenge to claims 6 and 14. As such, Patent Owner respectfully submits that the Board should hold both claims patentable.

II. ISSUES IDENTIFIED BY THE BOARD

1. Whether Petitioner's Challenge To Claims 6 and 14 Sufficiently Accounts For Obviousness Of The Entirety Of The Claimed Combination

Petitioner's brief begins with a false assertion that misstates both the position of Patent Owner, and the ruling of the Federal Circuit and the Board in this matter. Petitioner asserts that the Ex2-LN2 lens design of the Konno reference "meets all of the limitations of claims 1, 2, 12, and 13" of the challenged '712 patent. Petitioner

Brief at 1. The Board expressly found that the LN2 example in Konno did not disclose all elements of those claims, and the Federal Circuit affirmed that finding. Petitioner simply ignores this reality.

Petitioner suggests that its arguments regarding claims 6 and 14 involved modification of Konno both to 1) change the F# to 2.8, and 2) also to change the location of lens elements 4 and 5 of Konno so that they do not occupy the same physical space. Petitioner cites to pages 63-65 and 69-73 of the Petition as purported support for this. Petitioner Brief at 1. But those sections of the Petition discuss only the first of these two changes. They repeatedly refer to moving the aperture diaphragm to change the F#, but they do not reference adjusting the positions of lens elements 4 and 5 of Konno, nor do they set forth evidence of a motivation to modify the positions of lens elements 4 and 5 of Konno's Example 2. Petitioner does not suggest that Bareau or any other reference supplies the changed location of elements 4 and 5.

In fact, the cited sections of the Petition only discuss adjustments to Konno to change the F#. *See, e.g.,* Petition at 71 ("In view of this figure, a POSITA would have been motivated to adjust Konno's Example 20-LN2 lens assembly to decrease the F number and allow more light to pass through to conform to modern cellphone camera lens specifications."). These statements make no mention of modifying Konno to change the positions of lens elements 4 and 5. Indeed, none of the pages

of the Petition that Petitioner cites make any reference to lens elements 4 and 5 at all. Likewise, those sections make no reference to any of the elements of claim 1. Nowhere in the section of the Petition discussing claims 6 and 14 does the Petition discuss any of the elements of claim 1. Petitioner's discussion of its obviousness challenge to claims 6 and 14 begins at page 56 of the Petition and ends on page 74. Petitioner does not discuss any of the elements of claim 1 anywhere in those pages, and never suggests that it relies on anything other than its anticipation challenge (ground 1 of the Petition) to satisfy any element of claim 1, 2, 12, or 13 that is incorporated into either claim 6 or 14. The Petition itself makes no reference to particular modifications except to changing the location of the aperture diaphragm, nor does it suggest that other changes would be made to vary from the arguments set forth in Ground 1 of the Petition. Indeed, Petitioner's Opening Brief concedes that "Ground 2 necessarily relies on the analysis in Ground 1 to show how the Ex2-LN2 design meets claims 1, 2, 12, and 13." Petitioner Brief at 5.

Petitioner now argues that the Petition made oblique references to "correct[ing] the errors of Konno." Petitioner Brief at 2 (citing page 63 of the Petition). Notably, that section of the Petition made no reference to lens elements 4 and 5 of Konno, it did not specify the nature of the modification, it did not specify the motivation for the particular modification utilized, and it did not provide any showing that the modification would satisfy all of the elements of the claims from

which claims 6 and 14 depend. Several times, Petitioner's brief on remand cites to page 112 of its expert declaration (Ex. 1003 to the Petition) as purportedly supplying some of the missing information. Even if that were true, a careful search of the Petition reveals that Petitioner never cited to page 112 of Ex. 1003 anywhere in the Petition. Petitioner should not be able to change its arguments now that the Board and the Federal Circuit have rejected its challenge to the claims on which claims 6 and 14 depend.[1]

Remarkably Petitioner seeks not only to change its arguments, but to add an entire new ground to its Petition. It argues that the Board should now, after the Federal Circuit has affirmed the finding that the Petition failed to show that claims 1, 2, 12, or 13 was unpatentable, the Board should now consider an obviousness challenge to those claims that was never raised in the Petition. Petitioner Brief at 5-6. Petitioner cites no case since the existence of the relevant Inter Partes Review in which the Board or the Federal Circuit has ever permitted such arguments. The

[1] Petitioner also advances an argument that somehow Patent Owner waived any argument that the Petition failed to show that Konno did not disclose all elements of claim 1. Petitioner is wrong on multiple levels. First, Patent Owner did argue that Konno failed to disclose the elements of claim 1 without modification: "Without further adaptation and changes, Konno cannot itself anticipate claims to a physical lens assembly." Patent Owner Response (Paper 14) at 22. Second, the Board found that Petitioner failed to show that Konno discloses the elements of claim 1 without modification. FWD at 21-23. Third, the Federal Circuit affirmed this finding stating "the Board found that Konno could not anticipate the challenged claims absent impermissible modification. We discern no error with this conclusion." *Apple, Inc. v. Corephotonics, Ltd.,* 861 Fed. Appx. 443, 450 (Fed. Cir. 2021).

Supreme Court makes clear that this argument is entirely improper because only the grounds in the Petition are to be addressed. *See SAS Institute, Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018). Likewise, the statute authorizing this proceeding required Petitioner to describe "the grounds on which the challenge to each claim is based." 35 U.S.C. § 312(a)(3). Petitioner raised no obviousness challenge to claims other than 6 and 14, and it certainly cannot do so now, only after having a finding that other claims were not shown unpatentable affirmed by the Federal Circuit.

2. Whether The "Adjustable Iris Diaphragm" In Walker Is Relevant To Konno's Aperture Stop

In its Opening Brief, Petitioner argues that it did not actually rely on disclosures of an adjustable iris diaphragm in Walker in connection with its obviousness arguments. It is true, as set forth in Patent Owner's opening brief, that the Petition did not properly rely on Walker as part of its obviousness challenge (including because it did not suggest Walker was a part of an obviousness combination). Petitioner's arguments about Walker in its Opening Brief, however, are belied by its Petition. Petitioner now suggests that it was not pointing to teachings about an adjustable iris diaphragm in Walker in the Petition, but Petitioner highlighted references to exactly that on page 60 of the Petition. Petitioner now implicitly concedes that such an adjustable iris diaphragm would be inapplicable to the other prior art references on which the Petition relied.

3. Whether A Combined Lens Assembly Must Be Adjusted To Account For Optical Effects Of Changing Aperture Size

Petitioner fails to meaningfully address this issue in its brief. As explained in the Patent Owner response, the proposed modifications to the Konno example in Petitioner's ground 2 would result in various undesirable optical effects. Petitioner simply denies this reality, but has never actually addressed these issues, and still fails to do so. It merely cites to page 112 of Ex. 1003 (which was never cited in the Petition) to suggest that such optical effects were accounted for. Petitioner Brief at 10. But that figure does not address the Board's questions.

4. Whether a POSITA Would Have Modified Konno With Bareau As Proposed By Petitioner In Light Of Various Considerations

Petitioner fails to show that any of the considerations identified by the Board would have led to the combination on which it relies.

a. Konno disclosure of a first system with an F# of 3.0 and a second system with an F# of 4.0 and further disclosure of the advantage of making the second system darker than the first

Petitioner's argument amounts to little more than an assertion that because Konno recommended not changing the F# of the second lens element to be lower than the first, but did not expressly forbid it, that a person of skill would nonetheless ignore Konno's recommendation and adopt a contrary approach that was not explicitly barred. This argument lacks any reasonable credibility and points to no evidence from Petitioner's expert. Konno directly counseled against the very

modification that Petitioner suggests would have been obvious to a Person skilled in the art. That Konno –a skilled artisan on whom Petitioner relies – recommended against such a modification clearly shows the fallacy in Petitioner's contentions.

b. Bareau disclosure of a ¼" sensor with a field of view of 60 degrees and an F# of 2.8

The Board and the Federal Circuit have both already recognized that the relevant portions of Bareau relate to wide-angle lenses. *See Apple, Inc. v. Corephotonics, Ltd.*, 861 Fed. Appx. at 452. Petitioner now relies on statements in connection with a different IPR petition while ignoring statements by this Board in this IPR about "Bareau's teachings of a general preference to lower the F number in cellphone cameras **with wide-angle lens assemblies**." FWD at 28-29 (emphasis added). Petitioner's attempt to rely on random statements from other IPR proceedings (which were never part of the Petition here) is unavailing.

c. Petitioner's proposal to lower the F# of Konno's *second imaging optical system* to 2.8 – less than the F# of Konno's first imaging optical system

Petitioner concedes that this consideration mirrors item a above.

d. Petitioner's assertion that Iwasaki discloses a prior art lens system with TTL of 3.89, EFL of 4.0, and F# of 2.8

Petitioner points to Iwasaki as only purportedly showing a telephoto lens with a low F#. It points to nothing about Iwasaki that would have provided any

motivation to modify Konno as argued, nor anything to support any of the contentions in the Petition.

e. The Federal Circuit's inquiry as to whether "Bareau's teachings are limited to wide-angle lens assemblies," in light of the fact that Petitioner "sought to modify Konno's telephoto lens assembly"

Petitioner offers no separate discussion of this consideration.

III. CONCLUSION

Petitioner's response to the Board's order on Remand fails to provide any basis for the Board to sustain Petitioner's challenges to claims 6 and 14. It attempts to reargue determinations already made by the Board and affirmed by the Federal Circuit, and to improperly depart from the grounds advanced in the Petition. Petitioner failed to carry its burden, and claims 6 and 14 should be found not unpatentable.

Respectfully submitted,

Dated: December 7, 2021

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CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e)(1))

The undersigned hereby certifies that the above document was served on December 7, 2021, by filing this document through the Patent Trial and Appeal Board End to End system as well as delivering a copy via electronic mail upon the following attorneys of record for the Petitioner:

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Paper No._____

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

APPLE INC.,
Petitioner,

v.

COREPHOTONICS, LTD.,
Patent Owner

_____

Case IPR2018-01146
Patent No. 9,568,712

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PETITIONER'S RESPONSIVE BRIEFING PER THE BOARD'S ORDER AT PAPER 39

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PETITIONER'S EXHIBIT LIST

Updated: June 21, 2019

Ex. 1001	U.S. Patent No. 9,568,712
Ex. 1002	Prosecution History of U.S. Patent No. 9,568,712
Ex. 1003	Declaration of José Sasián, Ph.D, under 37 C.F.R. § 1.68
Ex. 1004	Curriculum Vitae of José Sasián
Ex. 1005	Reserved
Ex. 1006	Warren J. Smith, MODERN LENS DESIGN (1992) ("Smith")
Ex. 1007	U.S. Patent No. 7,918,398 to Li et al. ("Li")
Ex. 1008	U.S. Patent No. 7,777,972 to Chen et al. ("Chen")
Ex. 1009	U.S. Patent No. 8,233,224 to Chen ("Chen II")
Ex. 1010	Max Born et al., PRINCIPLES OF OPTICS, 6th Ed. (1980) ("Born")
Ex. 1011	Reserved
Ex. 1012	Jane Bareau et al., "The optics of miniature digital camera modules," SPIE Proceedings Volume 6342, *International Optical Design Conference 2006*; 63421F (2006) https://doi.org/10.1117/12.692291 ("Bareau")
Ex. 1013	U.S Patent No. 3,388,956 to Eggert et al. ("Eggert")
Ex. 1014	Japanese Patent Pub. No. JP2013106289 to Konno et al.
Ex. 1015	Certified English translation of JP2013106289 ("Konno")
Ex. 1016	Bruce J. Walker, OPTICAL ENGINEERING FUNDAMENTALS (1995) ("Walker")
Ex. 1017	Reserved

Ex. 1018	Reserved
Ex. 1019	Reserved
Ex. 1020	Reserved
Ex. 1021	U.S. Patent No. 9,678,310 to Iwasaki et al. ("Iwasaki")
Ex. 1022	Reserved
Ex. 1023	Course description of OPT 214 from the University of Rochester web site
Ex. 1024	Course description of OPT 244 from the University of Rochester web site
Ex. 1025	Deposition transcript of Duncan Moore, Ph.D.
Ex. 1026	Declaration of Dr. José Sasián in support of Petitioner's Reply
Ex. 1027	U.S. Patent No. 4,610,514 to Nakamura ("Nakamura")

I. Question 1: Petitioner's challenge to dependent claims 6 and 14 sufficiently accounts for obviousness of the entirety of the claimed combination in the Petition.

Patent Owner admits that the only reason Konno was found not to anticipate claims 1, 2, 12, and 13 was because of its erroneous overlap of the 4th and 5th lens elements. PO Br. at 2. Patent Owner cannot dispute that ***this error in Konno is fixed*** by the obvious modification of Konno presented in Ground 2, as explained in the Petition. *See* Petitioner Br. at 1-2. And, Patent Owner admits that Ground 2 otherwise relied on Konno's disclosures of all limitations of claims 1, 2, 12, and 13. PO Br. at 2. Indeed, Patent Owner never previously disputed that all limitations of claims 1, 2, 12, and 13 are disclosed by the obviously modified version of Konno in Ground 2. Its failure to do so previously means that its attempt to so argue now are waived and should be disregarded. *See* Scheduling Order, Paper 9, at 5; Trial Practice Guide at 94; *SAP Am., Inc. v. Versata Dev. Group, Inc.*, CBM2012-00001, Paper 81, at 2-4 (Sept. 13, 2013).

Specifically, Ground 2 builds upon Ground 1 and shows how a POSITA would have modified Konno's design based on Bareau's teachings to achieve a lower f-number. Petitioner's Brief at 1-2. Critically, that modification does not change any of the lens parameters shown to satisfy the limitations of claims 1, 2, 12, and 13 discussed under Ground 1 (*e.g.*, lens shape, lens thickness, and spacing between lenses that dictate focal lengths of each lens, TTL, and EFL), and at the

same time would have fixed the overlap error that Patent Owner alleged is "fatal" to Ground 1. *See id*., Ex. 1003, p.115. Petitioner explained not only the modifications a POSITA needed to make to the Ex2-LN2 design for a lower f-number (i.e., opening and moving the aperture and adjusting aspherics to better focus light) but also ***the parameters applied in Ground 1 that would not have been changed***:

> As shown above, the aperture diaphragm ST has been moved slightly toward the image-side of the lens assembly to allow more light to pass through the lens elements. In the above lens adjustment, only the aspheric coefficients were changed while maintaining the so called "paraxial" or "first-order properties" of the Konno lens, which a POSITA would have found to a be a simple solution ... ***The optical powers of the lens elements and lens spacing is the same as in the original Example 2-LN2 lens assembly***.

Ex. 1003, ¶66 (pp. 71-72) (emphasis added) (cited in Petition at 64-65).

Patent Owner did not previously identify any limitation from claim 1 that was not met in Ground 2. Thus, Patent Owner cannot be heard to dispute now, for the first time, that Ground 2 properly incorporates the analysis of claims 1, 2, 7, 12, 13, and 19 from Ground 1, Petition at 13-46, into the analysis of claims 6 and 14, Petition at 56-74.

Thus, the Ground 2 modification of the Ex2-LN2 design undisputedly meets all of the limitations of claims 1, 2, 6, 12, 13, and 14. *See* Petition at 13-46, 56-74.

II. Question 2: Patent Owner's arguments misconstrue Petitioner's reliance on Walker and raise new arguments that are irrelevant to the Board's question.

Patent Owner's arguments regarding the "adjustable iris diaphragm" of Walker not only misconstrue Petitioner's use of the reference but also raise new arguments not relevant to the inquiry at hand. First, Walker is not part of the combination in Ground 2. Rather, Walker is cited as evidence that the formula for f-number ($N = \frac{f}{D}$) was well-known to POSITAs and that POSITAs at the time of the patent would have understood the relationship between aperture diameter and f-number expressed in that formula. Petition at 60. In fact, Patent Owner's expert, Dr. Moore, admitted that a POSITA would have known this relationship as well as how to apply this knowledge to open the aperture to lower the f-number. Petitioner Reply, Paper 22, at 20-21; Ex. 1025, 105:2-16.

Patent Owner mischaracterizes Petitioner's combination as requiring a bodily incorporation of Walker's adjustable iris diaphragm with Konno's lens assembly. *See* PO Br. at 4-5 (*e.g.*, "the new aperture stop proposed by Petitioner surrounds the physical edge of the first lens element. Because that edge of the lens element is a physical object, the aperture iris diaphragm could not be adjusted."). But Petitioner does not rely on incorporating the physical aperture of Walker.

Further, Patent Owner's argument that Walker "describe[s] a hypothetical lens with an EFL of 143 mm" that "is not consistent with the compact lenses

addressed by the challenged claims" (PO Br. at 4) is new, waived, and irrelevant. The EFL of Walker's example lens is irrelevant to Walker's teaching of adjusting an aperture opening of a lens assembly to lower the f-number. *Compare* Ex. 1016, pp.4-6 (section 4.2 "Properties of a Thin Lens" including the disclosure of EFL = 143 mm) *with* p.6 (section 4.3 "Aperture Stop, Entrance and Exit Pupils, and Field Stop" discussing the "adjustable iris diaphragm"). As discussed in Petitioner's Brief, Walker's discussion of "adjustable iris diaphragm" is not limited to any particular lens, but instead broadly teaches that "***[a]ny lens assembly*** will have one lens aperture....Frequently the aperture stop will take the form of an adjustable iris diaphragm." Ex. 1016, p.6.

Patent Owner's new arguments that Walker is not applicable the lenses of the '712 Patent or Konno based on size differences are both new (and thus waived) and incorrect. Patent Owner's Brief fails to cite a single reference to the record for these arguments, showing not only that they are new but that they are unsupported by any evidence. The evidence of record, which includes the knowledge of a POSITA as demonstrated in Walker, amply supports that a POSITA would have been motivated to lower the f-number of Konno's lens assembly by first changing the aperture size rather than adjusting the focal length. Petitioner Reply, Paper 22, at 20-21.

III. Question 3: Patent Owner acknowledges that the modified Ex2-LN2 design is "adjusted to account for the optical effects due to changing the aperture stop size" and makes arguments based on erroneous data

Patent Owner does not dispute that the modified Ex2-LN2 design has been "adjusted to account for optical effects due to changing the aperture stop size" and actually refers to "Petitioner's proposed adjustments." Patent Owner Brief at 6. Instead, Patent Owner argues that a POSITA would not have lowered the F number of Konno's lens assembly in the first place because this would "creat[e] spherical aberrations, vignetting, and reduced relative illumination." *Id*. However, as discussed in Petitioner's Reply, Patent Owner's arguments are based on diagrams that are critically flawed because they were scaled in *inches* rather than *millimeters*, as specified by Konno. *See* Petitioner's Reply, Paper 22, at 22-24. Because of this error, the aberrations appear about ***25.4 times larger*** than what they should actually be. *See id*.; Ex. 1026 ¶ 13; Ex. 2013 at 69-87. Patent Owner never showed that the adjusted lenses presented in the Petition, ***when properly modeled***, would have poor image quality.

Thus, as shown in Petition, the modified Ex2-LN2 design was "adjusted to account for the optical effects due to changing the aperture stop size" according to the same method of software optimization that a POSITA would have used, and Patent Owner failed to present any evidence rebutting Petitioner's evidence that a POSITA would have successfully made the adjustments set forth in the Petition.

IV. Question 4: A POSITA would have modified Konno's Ex2-LN2 lens assembly with Bareau to have an f-number smaller than 2.9.

Patent Owner's arguments in sections D.1-3 are irrelevant because they discuss Konno's Ex2-LN1 lens, which the Petition does not rely upon. Patent Owner acknowledges that "[t]he only imaging optical system of Konno relied upon by Petitioner…to satisfy the elements of challenged claim l is the second system of Konno," *i.e.*, the Ex2-LN2 lens. PO Brief at 7. As discussed in Petitioner's Brief, Konno provides separate lens specifications for each of LN1 and LN2, and each represents a separate lens assembly that can be used independently from the other—facts which Patent Owner's own expert admitted. *See* Ex. 1015 ¶¶ 72-75; Ex. 1025, 120:21-121:2. LN1 is thus irrelevant, and Patent Owner's arguments relying on LN1 should be disregarded.

In all events, Patent Owner's arguments that LN1 teaches away from lowering the f-number of LN2 are inapt. *See id*. at 7-8. First, in sections D.1 and D.3, Patent Owner cites Konno's statement that "it is advantageous to make the second imaging optical system darker than the first imaging optical system." That statement does not and cannot "teach away," as Patent Owner contends, as it merely expresses a preference for the f-number of the telephoto lens to be higher than the wide lens. But Konno explains more precisely, in mathematical form as conditional expressions (5) and (5a), that the f-number of the telephoto lens can be

in a range that includes f-numbers lower than the wide lens, including an f-number of 2.8. *See* Petitioner's Brief at 14; Ex. 1015 ¶¶ 37-39. In other words, Konno's statement that making the telephoto lens darker may be "advantageous" does not supersede Konno's teaching that making a telephoto lens brighter (*e.g.*, by using an f-number of 2.8) is also preferable because it satisfies both conditional expressions.

Second, in section D.2, Patent Owner raises a new argument that, because "the F# for the first system (3.0) is … much closer to the F# (2.8) referenced in Bareau," a POSITA would have combined Bareau with the first (wide-angle) system and not the second (telephoto) system. PO Br. at 8. This argument should be disregarded, because it is both new and cites no evidence. It is also incorrect. Record evidence shows that f-number is based on only two properties of a lens assembly, the diameter of the aperture opening and the focal length. Petitioner's Brief at 7-8; Ex. 1016, p.59. The Board has already determined that field of view is irrelevant to a POSITA looking to lower the f-number. *See* Petitioner's Brief at 15; IPR2018-01140, Paper 37; IPR2020-00878, Paper 29 at 27.

In section D.4, Patent Owner raises another new argument, that "the other teachings of Iwasaki … make clear that it, like Bareau, describes a wide-angle lens, unlike the telephoto lens of Konno's second optical system." PO Br. at 10. This is yet another untimely new argument, which is both waived and irrelevant. This argument is also untrue as it relies on the field of view of Iwasaki's lenses to

define its type rather than the claimed telephoto ratio (TTL/EFL less than 1.0), which at least Fig. 4 with a telephoto ratio of 0.97 and f-number of 2.8 meets. *See* Ex. 1021, Tables 7 and 9. Iwasaki therefore further demonstrates that POSITAs were seeking f-numbers for telephoto lenses below 2.9 and would have been motivated to likewise lower the f-number of a telephoto design like Konno's Ex2-LN2 lens below 2.9. *See* PO Br. at 16; Petitioner's Reply, Paper 22, at 16.

In section D.5, Patent Owner argues that the combination of Konno's telephoto lens with Bareau's teaching of a 2.8 f-number for a ¼" sensor is a "mix and match" of wide and telephoto teachings. PO Brief at 10-11. But Patent Owner cites to no evidence showing that f-number specifications for a particular sensor (as in Bareau) would have been applied differently to wide and telephoto lenses. Rather, the evidence shows the opposite—that f-number is a ratio based on focal length and aperture opening diameter and represents the amount of light that passes through a lens. Petitioner's Brief at 7-8; Ex. 1016, p.59. This ratio applies equally to both wide and telephoto lenses. Ex. 1016, p.59.

Patent Owner also again argues that "Konno expressly teaches away" from the telephoto lens having a lower f-number than the wide lens. As discussed above and in Petitioner's Brief, this is untrue. Konno's conditional expressions (5) and (5a) expressly teach ratios where the f-number of the telephoto lens can be lower than the wide lens. *See* Ex. 1015 ¶¶ 37-39.

Respectfully submitted,

Dated: December 7, 2021

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(a), this is to certify that I caused to be served a true and correct copy of the foregoing "PETITIONER'S RESPONSIVE BRIEFING PER THE BOARD'S ORDER AT PAPER 39" as detailed below:

Date of service	December 7, 2021
Manner of service	Electronic Mail to: nrubin@raklaw.com; jchung@raklaw.com; rmirzaie@raklaw.com; mfenster@raklaw.com
Documents served	PETITIONER'S RESPONSIVE BRIEFING PER THE BOARD'S ORDER AT PAPER 39
Persons served	Neil Rubin C. Jay Chung Reza Mirzaie Marc A. Fenster Russ August & Kabat 12424 Wilshire Blvd., 12th Fl. Los Angeles, CA 90025

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